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FLEET BATTLE EXPERIMENT-INDIA

Assessment of Joint Medical Operations - Telemedicine (JMO-T)

by

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November 2001

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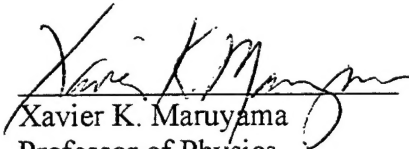
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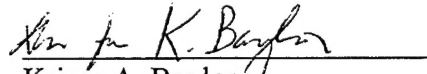
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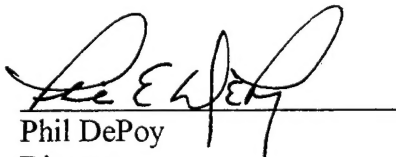
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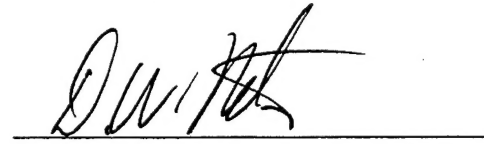

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ABSTRACT

This report contains assessments of the Joint Medical Operation, Telemedicine components introduced and exercised during Fleet Battle Experiment-India. Appendix 1 contains raw notes of observations taken during the exercise. It contains detailed chronological observations which form the basis for the assessment. Appendix 2 is a report by the CNA analyst discussing her observations and findings for the same exercise. It contains more thorough technical details from the perspective of the observer resident aboard the USS Coronado during the exercise.

The general conclusion is that the elements of JMO-T exercised during FBE-I show great potential. However, details need more careful work and evaluation before operational utility.

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FLEET BATTLE EXPERIMENT - INDIA
Assessment of Joint Medical Operations - Telemedicine (JMO-T)

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Introduction:

Joint Medical Operations - Telemedicine (JMO - T), is an Advanced Concept Technology Demonstration (ACTD), whose purpose is to facilitate operational and administrative aspects of medical care. The JMO-T was used with the Extended Littoral Battlefield (ELB) WARNET as the communications link. Its operation was observed from four locations during Fleet Battle Experiment - India, FBE-I.

Our assessment of the overall system is derived from direct observation of its field use during Marine Amphibious Landing Beach at Camp Pendleton; Fleet Combat Training Center, Pacific at San Diego; 3rd Marine Expeditionary Unit (MEU) at the Marine Corps Tactical Support Systems Activity (MCTSSA) and on the USS Coronado. A complete view of JMO-T was not available to any one user, and different functional views were seen at each location. We observed the hardware; examined the software interfaces; spoke with military users, contractor's installers, program designers and managers; read contractor provided system and component literature; and observed the systems being used. Our assessment is more in-depth, by being at four different locations, than could have been obtained from a single location.

The descriptions of the JMO-T's elements are in terms of their functional relationships, as observed. Since we were not privy to the design architecture and technologies of the system, the details may differ from the manufacturer or program intent.

Key elements of the JMO-T observed were:

Extended Littoral Battlespace (ELB) WARNET

The ELB WARNET is a communication network, which allows small units to communicate with their central command. The basic architecture consists of an end user terminal (EUT), a communication van, an airborne relay terminal (e.g. UAV, helicopter, satellite), and a receiver at the command terminal.

Medical Data Surveillance System (MDSS)

The MDSS objective is to monitor data input into the SAMS patient database and is a decision making aide to the Joint Task Force Surgeon. It enables trends in symptoms and disease to be highlighted for epidemiological purposes.

Medical WorkStation (MeWS)

Watchboard provides a collaborative planning and reachback support database; Annex Q, operational area reporting (medical logistics information, number of beds, etc.); and patient tracking information, and

Database Server, which provides input that accepts SAMS patient data, stores data, transfer and communications capabilities.

Shipboard Automated Medical System (SAMS)

The SAMS is a shipboard system used to document patient encounters.

Team Care Automation System (TCAS)

TCAS is effectively an email message system, which allows for communications between outlying units and the command unit.

Although the Joint Medical Operations-Telemedicine shows great promise, details in design, interface issues and implementation problems demonstrate it is not ready for operational adoptions. Certain elements are useful and can be implemented almost immediately, but these useful elements are not strictly products of the JMO-T. We will discuss various aspects separately and tie them together so that their functional and mechanical features can be better appreciated.

Network and Communication Link

Perhaps the most challenging and limiting aspect of JMO-T is in the networking and communications links, including database incompatibilities. JMO-T is based upon tying together commercial-off-the-shelf (COTS) components to achieve military functionality. As consequence, the primary task for the contractor community is to provide database translators, so one useful software program can communicate with another. There is no over-all design standard, so that some of the database transfers are effectively diodes and can transmit only in one-way communication. The inherent database incompatibility creates awkwardness in implementing relatively simple features, which would be useful to the fleet surgeon and to the end users in the field.

CHAT and Email capabilities

The ability to engage in two-way communication may be one of the most useful aspects of JMO-T. Common text can be transmitted via ELB WARNET, but continuity

of user participation is essential. The prior incoming message is not preserved. So, incoming and outgoing messages are segregated in different files. Consequently, if a simple query such as "What is the temperature in El Centro?", would evoke the response "101". If there is other communication between the query and the response, or if another replaces the user in one location, then the train of the conversation is lost. It is understandable that the CHAT content must be short, but at least in the command center, the ability to combine incoming and outgoing message by time would allow at least the command center to easily follow the conversation.

In addition to written queries, voice communication is essential. In one example, a real heat stress case appeared in the situational awareness map of El Centro. At MCTSSA which was monitoring the battlefield situational awareness map, it was not known to the Marine lieutenant colonel whether this medical event was real or simulated, nor whether it occurred that day or was a left-over mark from the previous day and whether assistance was requested. Written CHAT communication was not available and only the situational awareness map indicator was readily available to the monitoring officer. It was through radio communication, using the satellite based PC2 voice communication device, that it was confirmed that the event was real and not simulated. This took over an hour to resolve from the first inquiry. As observed, only one-way CHAT capability was effectively available.

Imagery

The present form of JMO-T is primarily for message and SAMS data transmission. Although not part of the present system, the ability to convey imagery is very helpful for diagnosis in the field. A crewman on the USS Bunker Hill sustained an eye injury and the corpsman onboard requested air medical evacuation during the exercise. The fleet surgeon was able to obtain a picture of the eye injury as a normal email attachment and the surgeon was able to diagnose the injury as non-critical and a medevac into the exercise's congested air space was avoided.

Presently, telemedicine is possible even with the use of the currently available email capability. At each unit with this capability, instant-imaging capability should be provided. The availability of digital cameras should make image transmission a possibility. The question is the availability of sufficient bandwidth.

Because the USS Bunker Hill is a large combatant, the communication capability was robust enough to allow two way image transmission. Although desirable, there probably is not sufficient bandwidth currently to allow this type of communication for a jump team in the field. However, as technology improves, the image conveyance should soon become possible for a battle aid station, where medevac and triage decisions may be aided considerably with better educated medical expertise.

Database Issues

SAMS data entry from the field is a tedious process. Corpsmen and medics in the jump team took about twenty minutes to populate each entry in the databases in the present end user terminals (EUT). Part of this is because there are fields which require diagnosis judgment by the EUT user, e.g. Subjective (paragraph for description or diagnosis) and Objective (patient entry evaluation according to injury).

Changes that would make the system more useful are as follows:

- a) The entries into the data field can be made different depending on what function the end user is fulfilling. The requirements for a jump team are different from a battalion aid station or a naval vessel, e.g. the USS Bunker Hill.
- b) Modifications of the entry data field could make the EUT small enough for use by a forward jump team and in the case where Medevac is being requested, a smaller device, such as a palm pilot could be used. This miniaturization of the end user terminal would make it a practical piece of field equipment.
- c) The data field should be compatible for both receipt and sending by the end user. This would allow for later completion of the SAMS data entry when immediate operational conditions would allow for more leisurely reflection and entry by the end user. (This modification would require extensive work by the contractor to make data fields compatible. Currently, for the MDSS and for SAMS, different databases are used since they are COTS products.)
- d) The MDSS will probably be used for large population bases such as in joint and combined operations such as Humanitarian relief operations. The scenario scripted for FBE-I was a refugee population. To be useful for such operations, two-way communication is essential. The goals and needs of the US military users may be considerably different from that of other United States agencies, even disregarding the different agendas of international and non-governmental organizations. The availability of security considerations have yet to be fully thought out.

Other issues which need to be considered involve decisions as for whom the total JMO-T system should be useful: For example, in monitoring refugee camps, the MDSS system needs to be able to aggregate information for different times and for different populations. The Joint Forces Commander probably would not need nor want the incidence of particular symptoms on an hourly or daily basis, but might find the information useful on a weekly or monthly basis. In monitoring for the possibility of an epidemic or biological attack, the military commander may need the information segregated by units or other characteristics. The fleet surgeon or epidemiologist may want the ability to monitor other groupings, such as date of arrival or by blood types. It is doubtful that all required groupings could be pre-determined. So, the fleet surgeon should have the ability to cross correlate any column of entry into the SAMS database against any other. Currently, the COTS databases do not allow this flexibility.

Another issue that needs to be addressed is the issue of "Saving Private Ryan," finding a person in a large group. The present system cannot handle large databases for

search processes. In certain situations, such as for the search of a particular name in a population of Hawaiians, Chinese, or Korean names, the present search capabilities are overloaded (This is because there are only a finite number of these names.). Search capabilities based upon other characteristics, date of entry into the database, blood type, location, unit, etc. would alleviate this situation.

The SAMS database has been designed for hospital administrative purposes and is not particularly compatible with battlefield injury situations. The modules should be reconsidered for battlefield situations. This may require consideration of encounter entries.

Test and Assessment Considerations

There is too much compartmentalization in software and elsewhere. For example, the designer of Watchboard, have one client in mind, but there are other users. Contractors tend to work only on the scope of the contract. Some independent assessment is needed to identify changes, which would accommodate the universe of users. The present evaluators are concerned with the subjective elements of the hardware and software. Their emphasis is evaluating JMO-T as a "black box" in its present form. More emphasis needs to be made on the evaluation of the technical military aspects.

For example, it was not until the end of the exercise that we were able to understand that many of the shortcomings came because the program is based on a COTS emphasis. As a COTS product, the databases are not created to be inherently compatible. The contractor's responsibility is effectively to provide one-way translators from one software vendor's database to another. As a consequence, two-way transfers are not possible.

The present concept is to have help teams consisting of resources at some designated on-shore station and a contractor stationed at the EUT location, e.g. riding aboard the command ship. Every time military personnel encountered a problem, whether minor or major, in using the JMO-T software, the contractor representative immediately stepped in to help resolve the problem. From an operational point of view, this is not effective. Military gear may be complicated, but the interface must be sufficiently simple and the software and equipment robust enough that it may be used by military personnel without on-the-spot guidance.

One of the items most lacking for JMO-T is the existence of a useful users' manual. The manual needs to be more than an "idiot" instruction booklet, and needs to have exposition concerning philosophy of design, history, and additional capability, much as a textbook would have. The present situation is that each user in each location has a view of the JMO-T as viewed through a narrow straw and understanding of the whole system is not easily available. Without observers at each of the locations, we would not have known what was happening. A common operating picture or philosophy was not easily available to the users at each of the different activities.

SUMMARY

The JMO-T system shows tremendous promise for field use. However, in its present form it is not robust enough and self compatible enough within its entirety to be close to field introduction. Analysis and integration of the system from the perspective of each of the users is necessary. Presently, JMO-T is too fragmentary to be relied upon for use by the military in an operational environment.

Attached are our raw notes on observations made during FBE-I . (Appendix 1)

Acknowledgement

Commander Lyn R. Burton, Medical Service Corps, USNR, Naval Research Laboratory. Science and Technology 220, was instrumental to the writing of this report. The on-scene observers, XKM and KAB are grateful for his aid in re-organizing and otherwise making this report more coherent than otherwise would have resulted.

**OBSERVATIONAL NOTES OF JMO-T DURING FLEET BATTLE EXPERIMENT -INDIA AND
RELATED EVENTS
(15-MAY TO 29 JUNE 2001)**

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**FLEET BATTLE EXPERIMENT - INDIA
Assessment of JMOT**

15-18 May 2001

USS Coronado for KBX wargames, JMO-T. Met Kathleen M. Ward, Center for Naval Analyses, 703-824-2029, wardk@cna.org. She was inputting scenario into the MDSS = Medical Data Surveillance System. One problem is that the program lumps symptoms so that many diseases of concern are not differentiated. E.g. upper respiratory and lower respiratory symptom are not differentiated, so diseases such as anthrax would not be captured and highlighted.

MDSS is useful in concept, but in practice, not. The ability to backtrack and display groupings at the discretion of the end user would enhance the program considerably. For example, it should be possible to display analyzed and semi-analyzed data before and after any program filters are applied. The trouble shooting should have been done by the program developers, not NWDC.

JMOT telephone numbers, Young 01-102-2, 7613; McCartin, 5115; Hancock, 5124. The program is supposed to be compatible with NDRS = Naval Disease Reporting System maintained by NEHC = Navy Environmental Health Center.

Story Board: Purpose of Epidemiology; Detection of Disease Trends in the Population; Identification of Specific Diseases in Population; Discrimination between Epidemic and Biological Attack; Provide Information to Decision Makers for Action.

FBE-I: 18 June depart; 25 June, return to port; 30 June, end of exercise.

MeWS, watchboard; user Administrator; password NHRDCAIC

I will be at Fleet Combat Training Center Pacific, (FCTCPAC)

18 Jun 2001

FBE-I. Fleet Battle Experiment-India. Stationed at Fleet Combat Training Center, Pacific (FCTCPAC). LCDR Krissa Baylor is a Navy reservist (Aerospace Physiologist) from the Bay Area. Her home telephone number is 408-238-7065 and her email is kbaylor@musd.org. CDR Rod Abbott (Physicist) who works at Livermore is the Operations Officer for their reserve unit and is also at FCTCPAC. Rod's telephone number at LLNL is 410-422-4410 and his email is abbott4@llnl.gov.

Before USS Coronado left port, Krissa and I visited the ship. We made contact with John Wolthuis who is the Medical Data Surveillance System (MDSS) software technician, Cynthia Kramer who is the SAIC technologies technician, LCDR Michelle Hancock who is the Deputy Fleet Surgeon onboard the USS Coronado, and Dr. Kathleen Ward from the Naval Warfare Development Command (NWDC) who is the medical scenerio developer for FBE-I and who will provide ddata to test the MDSS developed under the sponsorship of DARPA-NEHC.

Upon return to FCTCPAC, there was no CHAT communication concerning medical activity.

CHATline: when communication drops out, we lose the chat during the time of communication loss the chat is stored in the server, but because of loss of communication, the operational linkage cannot easily be recovered.

NPS email can be obtained by linking to <https://itwarrior.nps.navy.mil/exchange/logon.asp>

OTA bill can be found at <http://thomas.loc.gov/cgi-bin/query/z?c/07:HR2148>

19 Jun 2001

JMO-T ACTD. Joint Medical Operations-Telemedicine, Advanced Concept Technology Demonstration. Went to Camp Pendleton, ELB at MCTSSA, Marine Corps Tactical Support Systems Activity. Met Alfred Mitchell, Nick North and Roger Lisk from SAIC. These contractors comprise the Theater Telemedicine Team (TTT) whose job it is to provide support for the JMO-T technologies. The HF

data communication terminal is used to communicate among medical units and is fully compatible with SAMS 8.01, Shipboard Automated Medical System. The system is planned to be fully compatible with the future Joint Theater Medical Information Procedure (JTMIP). Also met with Army SGT Hall and PFC Ruff who will be using the system during FBE-I.

The unit is run off of a laptop and is contained in a protective box, approximately 3'x3'x4' and contains the MINC, microinternet controller (JINC = Joint internet controller) which is the hardware unit that allows connection to the HF (2-40 MHz) unit. The system has a global UPS, universal power source which converts almost all available electrical power sources to 110 V, 60 Hz AC. Current capability is through a Harris digital unit with 2400 bps. Upgrade expected in the near future is 9600 bps. Range is 3.5 to a 50 miles, limited by power and ionospheric conditions.

The system is capable of sending photographic information, as well as digital written communication.

The laptop may be used for 3 hours on battery and indefinitely through the power source.

Currently the communication radios for San Diego City is 900 MHz, San Diego County 800 MHz and the Navy uses 400 MHz. The MINC allows communication between these otherwise incompatible systems.

A feature which could prove attractive in the future is voice communication capability. This has not been incorporated because of lack of funding.

We first went to ELB and were given a short demonstration. The Coronado-ELB link was initially not available. (We believe this was because the Coronado was experiencing communication difficulties.)

We next went to the 1st Marine Expeditionary Force (1MEF) medical unit Bravo Company where two Navy hospital corpsmen were to give training on its use to the two Army medics. If tomorrow the army medics are able to use the system, then the unit is relatively user friendly.

The Army Medical (AMED) units have bought 200 of these HF Data Communication Terminals. The system was used in Cobra Gold 2001 in the Kingdom of Thailand.

20 Jun 2001

While waiting for the exercise to begin, we saw a vehicle prototyped by General Dynamics called Reconnaissance Surveillance Targeting Vehicle (RSTV). This is a HMMV type vehicle which has a smaller wheel base to fit inside a V-22 and weighs less (6500 lbs. vs 8000 lbs.), so that it can be flown as payload. The GD representative is Bill Tucker, a 1983 NPS graduate who had Hersh Loomis as thesis advisor. Email: tuckerw@gdls.com. The project manager is a former Marine COL Rick Duvall, email: duvall@gdls.com. The vehicle is constructed from commercially available parts and is a electromagnetic hybrid vehicle.

While we were waiting to go to Red Beach, the landing site for AAV's (Amphibious Assault Vehicles, 12 in number) and two LCAC's (Landing Craft Air Cushion), the medic-corpsman team attempted to enter data. Data entry was impeded because the EUT (End User Terminal = laptop) had a difficult cursor. Introduction of a mouse helped considerably in data entry and control.

The initial entry took about 20 minutes. Some of that was due to unfamiliarity with the data base and keyboard and program, some was due to social interactions among the 2 army medics, 2 navy corpsmen and one army evaluator. In a real situation, some of the database could be preloaded, e.g. demographic information. According to one of the corpsmen, the use of the pull down menu eliminated unacceptable entries. The Army evaluator was MSGT Flint, who had used the system in Thailand during Cobra Gold where the communicating units were land based. The only thing different in this situation is that the receiving unit is afloat, the USS Coronado. Navy Corpsmen were HM2 Smith, 760-763-0850/0701 and HM2 Simpson, 760-725-8099/0112.

The beach landing was quite impressive with the AAV's and LCAC's coming ashore from about three miles.

14:09 Received permission to submit report. We drove to a wooded remote site and tried transmission. The EUT being about 120 feet from the CV (Communication Van), did not have a good connection. When the EUT was moved to the van, connectivity to the Coronado was missing. We had a difficult time determining where the link was broken. A useful addition might be an automatic acknowledgement of receipt of signal, not necessarily information, from the CV to the EUT; from the aircraft to the EUT and then from the ship to the EUT. Only the last step is provided, so the data

transmitter does not know where the link is broken without arduous trial and error and guesswork. Communication from the aircraft revealed that the broken link was between the CV and the aircraft. It turned out the antenna amplifier had been turned off in the CV. In between, we were urged to move to higher ground, a move that was not necessary.

14:42 First report containing information about two people were sent out. (This was done by Fred Mitchell, the SAIC contractor.)

14:45 Acknowledgement of receipt of data received. Medics and corpsmen took over. No transmission was made because the EUT battery died.

Question: Why isn't earlier testing done outside of the exercise environment?

Moved to another location. Disease Non-Battle Injury (DNBI) report from the refugee camp was sent while in route and at new site. This was done from a pre-created data file. Most data sent required about 2 to 4 seconds. One took 64 seconds. (Protocol to decide when and how to resubmit when no acknowledgement is received is needed.) The DNBI was sent as a Team Care Automated System (TCAS) file without the SAMS software in the EUT.

Talking to the corpsmen and medics, one reason for slow battle injury data transmission is that the data collectors were making involved diagnostic calls on the spot. (Maybe this can be alleviated with experience or a protocol requiring quicker judgement.) There was only one hour allocated in the exercise for the data transmission and in reality many hours were needed. Each patient entry requires about 10 minutes to complete the multi-page report.

15:47 All 15 battle injury reports were received and acknowledged.

In the army context, the EUT and reporting system would be useful at a battle aid station (BAS), but its bulkiness would limit its usefulness. If the system could be put into a palm pilot, jump teams could use the software.

CV was developed by DRS Inc. David Breazeale was the engineer for the EUT.

21 Jun 2001

Back at FCTCPAC. FCTCPAC is not directly linked with the ELB Warnet, there is no communication with the medical activities in the field, or on the USS Coronado.

Items for consideration: The data entry for SAMS 8.01 is quite extensive. The entries are:

- SSN
- Name
- Encounter start time and date (default allowed)
- Visit type (e.g. initial)
- Height (inches)
- Weight (lbs.)
- Date/time vitals taken (default allowed)
- Blood Pressure Diastolic
- Arm (L or R)
- Position (Supine)
- Temperature (degrees Fahrenheit)
- Taken (oral, rectal, etc.)
- Pulse Rate
- Rhythm (regular/ irregular)
- Respiratory Rate
- Chief complaint
- Initial (user's id)
- Subjective (paragraph for subjective description or diagnosis)
- Objective (PE, patient evaluation, according to injury)
- ICD9
- Primary assessment
- ICD9
- Secondary Assessment
- Plan (plan at Battle Aid Station, BAS)
- Disposition (e.g. medevac)

For use by jump teams or when time is critical, the user should have the option to ignore fields except those they deem critical. There should be the ability later on to fill in the other fields depending on field activity density. Also, in an ideal situation, certain fields like SSN and names could be pre-entered for all combatants in a local unit. (e.g. platoon) There is a danger of having too much data preloaded in a pull down menu because each entry detracts from the time needed for the encounter and data entry. As currently designed, the data entry is time consuming (HM2 Simpson's comment was "tedious") and in a triage or medevac request situation, there are too many fields to enter. A combination of training and data entry format could alleviate this problem.

Tomorrow, we will go back to Camp Pendleton and make contact with the 1st LT, who is the J4. CDR Rod Abbott was there today and relayed that there were battle casualties in the war scenario. The war scenario battle casualties may not be directly connected with JMO-T, but should give us a better appreciation of how casualty reporting is done operationally today.

The FBE-I website has a block for **medical** communication according to the *network centric warfare* concept. There are no entries under medical. Why is this?

22 Jun 2001

We spent the day at Camp Pendleton in the marine tent/spaces which mimicked the USS Bonhomme Richard, which was removed from the experiment due to trouble with a boiler. We met CAPT Joon Um, J4.

The communication van is marked A = Army, M = Marine, U = UOC = Unified Operating Command. The UOC was run by John Johnson, SPAWAR, who seemed very knowledgeable. Government employees tend to have a broader and less restrictive knowledge of the equipment than contractors. The UOC is capable of easily handling 10 - 15 EUT's and has the capability to monitor where links exist or are broken. This information should be made available to the EUT's, so that the operator of the EUT can determine where the communication failure exists. The UOC CV was about 400 feet from the EUT in the marine spaces.

Question: Are military personnel being trained on the CV? I saw no uniformed personnel in the CV, only contractors and one government employee. Knowledge by the EUT user concerning the function and capabilities of the CV helps understand the system and is useful in troubleshooting communication problems.

Yesterday, I found out that the Coronado is coming back to North Island rather than the sub base because Point Loma masks communication satellites about 40 % of the time.

At about 09:10, a casualty re-appeared (from an exercise the previous day) on the situational awareness map of El Centro. It was not until about 09:45 that confirmation was made that this had been an actual heat stroke condition, not a simulated one. EUT user needs to be trained to provide written communication as email when using the JMO-T system. The confirmation was made by a PC2 satellite relayed voice message. This situation also illustrates the utility of incorporating voice capability to the ELB WARNET.

There was still confusion as to whether the heat stroke event was new or yesterday's event. Voice communication to clarify the situation as yesterday's event was finally made at about 09:58, some 50 minutes after first noticing the event marker on the situation map. The event marker (a red cross) on the situational awareness map should have available date/time stamp of the message, so the on-scene commander can tell when the event occurred.

Observing the activity within the marines' space, in this situation, the marine LCOL functioned in a staff capacity to the Coronado. It was not clear who was in charge of the observations of the situational awareness graphic display. The red cross remained with no indication as to whether action had been taken or even whether it had been observed by a person with an active role in the exercise.

25 Jun 2001

LCDR Baylor returned to Camp Pendleton and was able to copy both the casevac communications, and the Combat Services Support Request (CSSR) communications from the El Centro drills last week as text reports that can be used to compare timing of a request and response, should this information be useful.

I came on board the USS Coronado.

Kathleen Ward, CNA, had to leave for family reasons.

There was a conference with PACOM concerning last week's activities. During the discussion, the ability to see the same visual display was very useful. However, the discussion was done with verbal communication, not email. The importance of voice communication was seen here also, since immediate response allowed for a meaningful discussion.

One of the questions brought up in the conferencing with PACOM was why it took so long (15 - 20 minutes) to enter data for each incidence/patient. My observations:

- a) The data base should be constructed for minimal input filling in other fields later when time is not a factor. When the personal hand held communicator is used (JEDI?), there should be an option where pad button input should be allowed for certain action requests such as medevac.
- b) Part of the time is social. There too many people, 2 medics, 2 corpsmen, several contractors and others looking over the corpsman's shoulder while data is being placed into the system.
- c) The corpsman felt that he had to make diagnosis as he entered the data. There are fields which ask for subjective evaluations. Therefore, an evaluation can take time for a conscientious medic/corpsman. The construction of the minimal data input needs considerable thought.

The PACOM RADM made an observation that "without data input, there is no system." There are events which do not show up unless routine input is made. Routine data collection protocol needs to be defined so that emerging disease trends and epidemics can be seen.

DNBI and Battle Injury (BI) data should be incorporated into a map. Such a map with useful color coding would allow for detection of epidemics and biological attacks.

Camera image is useful. In a real case, a seaman onboard the USS Bunker Hill had an eye injury and a diagnosis for medevac was made. Exchange of images as normal email attachment enabled the 3rd Fleet Surgeon to properly make the diagnosis that the injury was such that medevac was not needed. Had medevac been made, then there would have been an unnecessary impact on other operations.

(The USS Lake Champlain had a case of appendicitis which had to be medevaced.)

Identification signs on various EUTs, pc's:

MeWS: Medical Workstation

Watchboard

- Collaborative Planning and Reachback Support
- Annex Q Operational Area Reporting (medical logistics info, # beds, etc. ...)
- Patient Visibility

Database Server

- Input: SAMS Patient Data
- Storage
- Transfer
- Communications

MDSS: Medical Decision Support System

Disease Trend Analysis

Outliers / Bursts

Summary Reports

Met LCDR Tom Moskowitz, on the staff for PACAM Medical Admin at Ft. Smith, Hawaii. Maj. Dean Doering, USAF, will be Tom's replacement.

Weekly Aggregate DNBI data would be useful for humanitarian relief, refugee camps. This relates to earlier comment about routine data entry. Right now we have "new visits" and "revisit" categories, but also need categories of "combat related" and "not combat related" as well as "admin categories" (e.g. physicals).

TCAS: Team Care Automation System (data input for all medical systems).

TCAS contains messages. Currently, only the new immediate message is the message traffic stream. Incoming messages and outgoing messages are in different files. The capability to intersperse the outgoing and incoming message may be useful to follow discussion streams. This should be done according to message time sent, for example . . . Outgoing: "What's the temperature there?" Incoming: "101". Without the temporal connection between these two message, the outgoing file only shows "What's the temperature there" without connection to the response. Sometimes the messaging connections are severed, so the operator may not be able to determine what is going on when there is only the message "101", without reference to the original query. Currently, TCAS returns to top of list if a message is opened up. Technical fix is to return to the point of departure when a message is opened.

Procedure: Most operators do not fill in the subject heading. Putting in a brief subject heading would allow for better, more efficient communication. In addition, most experienced operators initial or sign the messages so that the receiver knows from whom the message is coming. Since EUTs in the field are not user specific, signatures are useful in maintaining communication streams.

Spent time with LCDR Michelle Hancock concerning the websites for FBE-I. There is a 1MEF/JTF website which is supposed to contain all exercise-related message traffic. The JMO-T message traffic appears to be on this system. However, there is a parallel NWDC FBE-India website for the JTF. It has

space for Medical, but it is empty. There is full traffic for Joint Fire, Counterforce. This system seems to be sued at FCTCPAC and UAV traffic is on the discussion.

Contacts: Charles D. Updegrove, MTS Tech., 301-319-1179

CDR Scott Sherman, MD, MPH, Epidemiologist, 619-556-7070. Scott is an epidemiologist who was in the medical spaces on the Coronado during FBE-I.

LCDR Baylor observed a late afternoon presentation onboard the USS Coronado. It concerned JMO-T capabilities, and was given by Fleet Surgeon CAPT Jeff Young, and CDR Scott Sherman, to members of the press/media.

26 Jun 2001

USS Coronado was in a state of good behavior because Prince Andrew was coming over on the Admiral's barge across San Diego Harbor from the convention center where there is a big biotechnology conference. The barge was accompanied by two San Diego police boats full of a crew of about ten policemen.

Teleconference with PACOM surgeon general, who is also the CINCPAC surgeon general, RADM Dennis Wright, J07.

IMACS = situational awareness maps.

Visit by CAPT Dean Bailey, AirPAC surgeon.

A point brought up in several discussions is whether all of new equipment reduces the up-front presence of personnel. There is general consensus that serious analysis should be a rear echelon function. In JMO-T, the current concept is to have a "help desk team" with two contractor technologists riding with the ship. This would increase the number of bodies in the medical spaces on board the ship.

It appears that there are at least three reporting systems in play during this experiment. There is the NWDC FBE-I webpage which is monitored by those in the JOC for airpower support. The experimental side of the medical is contained in the IMEF/KBX web page and then there is the normal system used when not in FBE or KBX. The heat stroke case reported last week should have been using the normal operational system, but was placed into ELB experimental system.

Conference with Dan Gower, gowerd@vrinet.com, senior analyst for Vector Research, Inc. accompanied by Stephen Randolph, Randolphs@vrinet.com, policy analyst. Vector is tasked to do testing and evaluation for the JMO-T system. Earlier, Mike Eby and Dennis McCartin had approached Vector about collaborating with NSWC about testing and evaluation, but the effort did not get anywhere (probably because NSWC did not offer to pay for their participation.) They had a questionnaire which gets user reactions to JMO-T. We sat around a table with SAIC technicians (Cynthia Kramer and John Wolthuis), fleet surgeon (CAPT Jeff Young), epidemiologist (CDR Scott Sherman), two medical corps personnel (LCDR Michelle Hancock, deputy fleet surgeon, and CDR Dennis McCartin). In addition, LCDR Krissa Baylor, Tom Moskowitz, PACOM MSC, Dean D *, USAF MSC, Charles Updegrove, MTS, and I were also in attendance.

The purpose of the Vector interviews is the answer the following two questions:

1. How well did the system work?
2. How well it help the mission? (potential)

The questionnaire will be graded on a 5 point Likert (linear): Strongly Agree = 1, Agree = 2, Neither Agree nor Disagree = 3, Disagree = 4, Strongly Disagree = 5, Not observed = (0). This scale does not normalize the individual respondent's tendency to respond high or low.

Some comments heard at the interview.

1. There is no ability to input aggregate data. For functions such as refugee camp monitoring, what is needed for command response is aggregate daily or weekly input.
2. To the question as to whether the Watchboard/MDSS software is compatible with the command and control C2 system (CINC21?), the answer seems to be potentially, but not in its present configuration. For example, Joining Report = Initial Capability Report, could be accommodated with a simple change of page heading.
3. SAMS is not designed for wartime casualty. It is more for hospital administration. Provisions should be made to redesign SAMS to accommodate encounter modules.
4. There is too much compartmentalization in software and elsewhere. For example, the designers of Watchboard have one clientele in mind, but there are other users. Contractors tend to work only on the scope of the contract. Some independent assessment is needed to identify changes which would accommodate the universe of users.
5. The search field is limited. More consideration should be given to possible uses for the search and find out if there is enough information available to make a useful search. For example, in a coalition situation or a large refugee camp situation involving Chinese or Korean populations, would an individual be located. (There are only about 800 last names in these populations)
6. Would an alias naming system be useful? (e.g. Tarawa1, Tarawa2 indicating the sequential events and entries from the Tarawa). Any alias would have to be noncritical field which would be for the benefit of the Fleet Surgeon for his purposes.
7. The ability to aggregate data fields, e.g. blood types, type of injury, location, etc, would be useful for the Fleet Surgeon to assess situations. This relates back to an earlier observation that MDSS should be able to back track to the raw data and allow plotting in different ways.
8. A good user manual is needed. The user manual should go beyond the cookbook, step 1, step 2 approach, but should contain discussion of the topics and philosophy. This might be a textbook type manual.
9. Database should be compatible with all services databases.

We tried to obtain copies of the MDSS/MeWS filled out questionnaires, but were told by Vector people that we could only receive processed data.

I opened the two files LCDR Baylor saved as text files from the exercise at Camp Pendleton last week. Casevac stands for cases potentially requiring evacuation during the exercise. It is a fictional entry into SAMS.

Example is given below:

Source: RSTATM1BVTRSTATM1
Call Sign: STALKER1
Freq: -0.0010 Hz
Priority: URGENT
Required on: 191601Z JUN 01
Pickup site: 11SMS6040983976

Site markings: Pyrotechnic Signal
Pickup type: Air
POC: SGT MAY
Number of casualties: 1
Nationality: USMIL
Security: ENEMY
Narrative: RSTATM1--
YOO HOO 564948554 B+

FELL BACKWARDS DOWN A NEAR VERTICAL SLOPE...OPEN WOUND ON THE LEFT SIDE
OF HEAD....HAS A METAL STAKE THROUGH RIGHT THIGH.....

Combat Support Services Request (CSSR) pertains to messages for equipment support. Examples are given below:

Subject: CSSR
Date: 22 Jun 2001 09:26:46 -0700
From: SHNM
Organization: Shared Net
Newsgroups: cssr,cssr
Message Type:CSSR
services :
principleEndItem :
message.supplyInfo[0].unitOfIssue : EA_UOI
message.supplyInfo[0].quantityUnitPack : 0
message.supplyInfo[0].quantityOnHand : 0
message.supplyInfo[0].quantityExpended : 0
message.supplyInfo[0].quantityAuthorized : 0
message.supplyInfo[0].consumptionRate : 0.0
message.supplyInfo[0].quantityRequired : 0
message.supplyInfo[0].quantityAvailable : 0
message.supplyInfo[0].NSN :
message.supplyInfo[0].SAC : Unknown Supply Account Code
message.supplyInfo[0].supplyClass : Unknown supply class
message.supplyInfo[0].quantityGreen : 0
message.supplyInfo[0].quantityYellow : 0
message.supplyInfo[0].partNumber :
message.supplyInfo[0].description :
endItem :
requestPriority : IMMEDIATE
requiredOn : 993226699
instructions : NEED 1300 5.56 BALL, 5000 5.56 LINKED, 10000 7.62, 5000
9 MM,
pointOfContact : CO GYSGT
requestStatus : Unsent
requestLocation.Latitude: 32.8154984431494
requestLocation.Longitude: -115.663736984929
requestLocation.Altitude: 0.0
requestLocation.MGRS: 11SPS2509231624
serviceUnit :
narr :
acknowledged : false
userId :
loginName : LCO5MCO
messageId : Unknown

messageNumber :
dateTime : 0
observerLocation.Latitude: 0.0
observerLocation.Longitude: 0.0
observerLocation.Altitude: 0.0
observerLocation.MGRS:
reportingTrack : lco5mcoBVTLC05MCO
informationSource :
View_role : CTP

Subject: CSSR
Date: 21 Jun 2001 13:41:07 -0700
From: SHNM
Organization: Shared Net
Newsgroups: cssr,cssr
Message Type:CSSR
services :
principleEndItem :
message.supplyInfo[0].unitOfIssue : EA_UOI
message.supplyInfo[0].quantityUnitPack : 0
message.supplyInfo[0].quantityOnHand : 0
message.supplyInfo[0].quantityExpended : 0
message.supplyInfo[0].quantityAuthorized : 0
message.supplyInfo[0].consumptionRate : 0.0
message.supplyInfo[0].quantityRequired : 0
message.supplyInfo[0].quantityAvailable : 0
message.supplyInfo[0].NSN :
message.supplyInfo[0].SAC : Unknown Supply Account Code
message.supplyInfo[0].supplyClass : Unknown supply class
message.supplyInfo[0].quantityGreen : 0
message.supplyInfo[0].quantityYellow : 0
message.supplyInfo[0].partNumber :
message.supplyInfo[0].description :
endItem :
requestPriority : ROUTINE
requiredOn : 993155721
instructions : chow request
pointOfContact :
requestStatus : Unsent
requestLocation.Latitude: 33.3190146149518
requestLocation.Longitude: -117.473792966972
requestLocation.Altitude: 0.0
requestLocation.MGRS: 11SMS5590086754
serviceUnit :
narr : 35S3--
Move to this coordinate. Fill the chow request. Acknowledge you have
received this request and on delivery of chow.
acknowledged : false
userId : 35S3
loginName : 35S3
messageId : Unknown
messageNumber :
dateTime : 0
observerLocation.Latitude: 0.0
observerLocation.Longitude: 0.0
observerLocation.Altitude: 0.0
observerLocation.MGRS:
reportingTrack : 35S3BVT35S3
informationSource :
View_role : CTP

Subject: CSSR
 Date: 21 Jun 2001 13:04:55 -0700
 From: SHNM
 Organization: Shared Net
 Newsgroups: cssr,cssr
 Message Type:CSSR
 services :
 principleEndItem :
 message.supplyInfo[0].unitOfIssue : EA_UOI
 message.supplyInfo[0].quantityUnitPack : 0
 message.supplyInfo[0].quantityOnHand : 0
 message.supplyInfo[0].quantityExpended : 0
 message.supplyInfo[0].quantityAuthorized : 0
 message.supplyInfo[0].consumptionRate : 0.0
 message.supplyInfo[0].quantityRequired : 0
 message.supplyInfo[0].quantityAvailable : 0
 message.supplyInfo[0].NSN :
 message.supplyInfo[0].SAC : Unknown Supply Account Code
 message.supplyInfo[0].supplyClass : Unknown supply class
 message.supplyInfo[0].quantityGreen : 0
 message.supplyInfo[0].quantityYellow : 0
 message.supplyInfo[0].partNumber :
 message.supplyInfo[0].description :
 endItem :
 requestPriority : ROUTINE
 requiredOn : 993153648
 instructions : chow
 pointOfContact :
 requestStatus : Unsent
 requestLocation.Latitude: 33.3058109707742
 requestLocation.Longitude: -117.441592538184
 requestLocation.Altitude: 0.0
 requestLocation.MGRS: 11SMS5889185277
 serviceUnit :
 narr : 35S3--
 Respond to this request. Physically move to this location. LT C
 acknowledged : false
 userId : 35S3
 loginName : 35S3
 messageId : Unknown
 messageNumber :
 dateTime : 0
 observerLocation.Latitude: 0.0
 observerLocation.Longitude: 0.0
 observerLocation.Altitude: 0.0
 observerLocation.MGRS:
 reportingTrack : 35S3BVT35S3
 informationSource :
 View_role : CTP
 In a real situation, ie. request for chow, water or medical use the
 word
 "Cherry" to begin your request followed by "picker". This is
 universal
 any real request.

(Note that this message says "cherry picker" is a real request. Conversations in the Marine tent lead us to believe that "cherry picker" were simulated events. The vocabulary is unique to this unit and needs to be

standardized. Simulations and real requests need to be differentiated. The Kernal Blitz documentation says that "cherry picker" is simulated.)

Met former student Jon Wood, executive officer of EOD Mobile Unit 3. We went to see the dolphin pens on Point Loma Submarine Base. It appears that the Navy does not put a lot of resources into the operational navy. The buildings go back to World War II and have had been knocked off their foundation and re-propped up.

27 Jun 2001

Back to USS Coronado. Discussion with Cynthia Kramer. After pressing her on certain capabilities and issues regarding the JMO-T software, I found out certain elements of the program that I had not fully appreciated before. JMO-T is a Commercial Off-The-Shelf, COTS, program which explains why the data bases among certain parts are not fully compatible. From what I gather, the main contribution of the contractors is to provide translation software so that field units can send data to populate datafields of more sophisticated higher echelon commands. In effect, the end user sends data which is cached by an echelon 2 command which may use it within itself. In analogy, the end user is like an ambulance, which forwards information to a hospital. Internally within the hospital, the different units, e.g. admissions, bed supplies, test lab, etc., have two way pipes to receive data and send data to the central repository. The echelon 1 unit effectively has only the ability to send the data, but not to receive or query from the central repository.

After considerable discussion with Cynthia and later with Cdr. Sherman, they do not believe two way data sending ability is necessary nor desirable. First, the lower echelon units are too busy in the heat of battle to deal with incoming data and second, the communication is usually by HF so there is insufficient bandwidth to transmit data. The data size transmitted by the EUT is 1 kilobyte. (This limitation seems to say to me that voice communication is more essential.)

Asking Cdr. Sherman if the MDSS was useful as scripted, he was of the opinion that the scenario for this exercise was not realistic. The military would not get so intimately involved with refugees as to require data on an individual basis. The only data that would be useful would be aggregate data. (If the MDSS software is marketed to the NGO and Humanitarian aid community, its search capability limitation must be clearly put forth.) If it is not to be used with a large population such as in a refugee population, I have a problem with the change detection indicators. In most military situations, the case numbers will be relatively small, so making change indicators based on one to three standard deviations may not be meaningful if we are tracking individual events. The scenario scripted did not address the military utility of the MDSS program.

Further discussions with Mike Sovereign and R. Kemper from NPS revealed the following. The Marine Corps has never felt that they would have sufficient satellite bandwidth. Consequently, they are pushing ELB WARNET. The Navy fires exercise are carried out by SIPRNET. CINC21 is a communication network which includes, uses, or is part of SIPRNET, but at this point is quite immature. NIPRNET and SIPRNET uses commercial satellites and commercial internet links. The driving force is to go commercial and have very few things which are exclusively military. I don't think much thought has been put into the philosophical question as to what is the military. By function, civilian contractors must now be considered military? There are several other communication links. Hardly anyone has an overall view of the link situation.

Generally, contractors are very constrained in that if it is not something they are being paid for, they do not deal with it. The issue of how to deal with concerns and items not specified in the contract needs to be addressed in using systems such as JMO-T

In addition several billion dollars are being used to impose the Navy/ Marine Corps intranet under a contract to the Dallas Company started by Ross Perot (E???). Under this concept, all the local area networks and machines which are locally controlled will be managed by one Navy Command. Apparently there is now talk of a three star billet for Navy IT. (this comes from the Third Fleet deputy PAO).

28 Jun 2001

Went to FCTCPAC. Most activity shut down.

Used the San Diego Trolley system. During the middle of the day, it is pretty full. My guess is that every 15 minutes a five car train with capacity of about 50 per car runs. It looks like it is used

extensively by commuters from Tijuana and by attendants at the baseball games. There are two lines, the Blue Line runs between the San Diego Mission and Tijuana and the Orange Line starts downtown and goes out southeast.

29 Jun 2001

Hotwash, Kernal Blitx (X).

The wrap-up meeting of KB(X) and FBE-I was held at the Amphibious Training Base theater. The format was to present each topic with 3 positive and 3 negative bullets with discussion interspersed. (My comments will be in parenthesis.)

General:

+ Naval Fires Network:

- + Ku Band Satellite Network
- + IO Network Defense Network, (hacking text tested and seems to work.)
- Unclassified network on ECOC (WARNET does not conform to classified standards. It conforms to COTS 128 bit encryption, but that is not good enough for national security.)
- Split IP GBS (not tested)
- JCSE (= Joint Continuous Strike Exercise, work other systems to make work, it is a comparison program. It was not tested.)

JFMC:

- + Control of Fires (who votes?)
- + RTC/TES-N is potential ISR force multiplier
- + Littoral Penetration Area (complicated layers)
- Targeter and Weaponer pair (they should be in the same space)
- LAWS Operator experience
- Execution and planning tools (need to develop)

JFACC

- + greatly increased spread
 - + improved joint collaboration
 - + improved situational awareness
 - paucity and reliability of live ISR assets (UAV, satellites?)
 - low density and fidelity of ISR injects into exercise
 - fragile interfaces between systems and equipment
- (only had 5 U2's and 2 JSTARS; NFN needs simulated access)

MARFOR/MCWL

- Timeliness of mensuration of tactical targets (took 40 minutes)
 - Simulation package
 - Limitation of Radiant Mercury System Interface
 - + Enhanced common tactical picture/ battlespace awareness
 - + Improved IMMACCS/ WARNET System Stability
- (unclassified side showed no air assets, must have classified interface)

| System | Works ? | Tactical Value |
|--------------------|--------------|-------------------------------------------------|
| WARNET | yes | high |
| BVT (CTP) | yes | H* Low (H* with classified access, low without) |
| CHAT | yes | high |
| NEWSGROUPS | yes | low |
| IVOX | Intermittent | Unknown |
| EUT | yes | medium |
| CUSEEME/whiteboard | barely | low |
| LAWS | yes | medium |

JSOTF (Joint Special Operations Tactical Force)
Notional play – planning and execution (no)
Collaboation tools and connectivity (no)
LAWS, GCCS, GISR-N (no)
Information management (no) (3 different web pages, no standard)
Unattended Ground Sensors and Aerolight UAV (no)
(aerolight UAV is not useful unless it is man portable)

Intelligence:

- + Collaborative tools
 - + Web-based posting of intelligence briefs
 - + Intelligence preparation of the battlefield
 - COP dedicated to the intelligence sector in the JOC (overlay needed)
 - Training prior to experiment
 - Collection Manager vrs ISR manager
- (stopping for twice daily brief is disruptive)

Command and Control:

End User Terminal (EUT)
CHAT ROOMS
WARNET
IMMACCS
PLI

Joint Fires:

- + Integration of system
- + Rapid Sharing of Information
- + Decentralization of Execution
- Integration of Experiment
- Analysis of Combat Information
- Enforcement of GICOT

Communications :

Navy/Marine Corps Cooperation
Experimentation: Team Apps
Com Ex/
...

FBE-I:

Wideband network centric communication to all nodes
TTP development and system evaluation with USMC (JTF Staff/components)
USW integration into the DFN provided shared SA and enhanced warfighting capability
Incomplete/ not fully planned ISR plan degraded the TCT process
Nodal mensuration was not reliable
Experiment Complexity demanded longer workups

ELB:

Successfully shared tactical picture between LFCC, ARFOR and fielded forces
WARNET supported NFN LTC and JMO-T
Demonstrated WARNET ability to interfere with standard network systems
Net management needs work
Net robustness good but not seamless
Collaborative planning applications and IVOX not optimized for WARNET use
(a 200 know airplane was used rather than a slow moving UAV so coverage was not even)

CINC21

- Building CINC's and CJTF daily briefs
- Collaboration
- Visualization tools
- Medical Support
- Counterforce experiment support
- Training and Assessment
- XIS real time incidence
- CTP –common tactical picture
- Medical support- entrepreneurial
- Whiteboard
 - (O5's and O6's need training perhaps more than the operators)

JMO-T

- + Replaces traditional msg/ radio traffic
- + Improves centralized management
- + Provide digital two-way comms and file transfer (Limited)
- End user data entry capability
- Database search capability (needs Boolean algebra capability)
- Medical Watchboard Format

Trend analysis
Separate DNBI/ Casualty databases
CINC21 collaborative planning was helpful

Data entry-SAMS
8000 entries –reachback capability needed
watchboard format – COP did not exist (IMMACCS)

KB (X) director:

- Wargame
- Contractor support for paperwork , e.g. MSEL list
- Uniforms in charge – continuity of program leads (who's in charge)
- Net accreditation issues – installs (xpt does not own network)
- ISR assets
- Berthing availability

ELB – CINC21

PAO, DV media events held on weekend, media response small

Closing:

The order of priority was network, sensors, weapons systems and platforms. This is opposite order of previous games.
JTF – not all players were there
No robust enemy environment
Have commander decide what he wants to see
Squad leaders depend on accuracy of COP (Date/time stamp needed)

DOTES – Doctrine, Operations, Training, Education System

MCO2 in one year.

Appendix 2

10 August 2001

FBE-I Exercise Report: JMO-T ACTD

Kathleen Ward
Center for Naval Analysis

Executive summary

Fleet Battle Experiment India (FBE-I) Far Forward Casualty Care Initiative provided the initial opportunity to experiment with the Joint Medical Operations-Telemedicine Advanced Concept Technology Demonstration (JMO-T ACTD). The overall goal of this technology demonstration was to provide a medically-oriented decision support system to the Joint Task Force Surgeon (JTF Surgeon). The ability to detect potential epidemics, to predict shortfalls in blood and medical supplies, or to follow patient and/or staffing levels at various JTF treatment facilities are all crucial to maintaining the medical, and more importantly, the operational capabilities of the Joint Task Force.

Experimentation efforts were divided between two core technologies that make up JMO-T ACTD: the Medical Watchboard (MeWS) and the Medical Decision Support System (MDSS). The experiment patient population was built around both military (Injured: ~100, DNBI: ~200) and civilian patients (DNBI: ~6000) in refugee camps. Military injury patient encounters were entered via the Shipboard Non-Tactical ADP Program (SNAP) Automated Medical System (SAMS) patient encounter module. Additional Disease Non-Battle Injury (DNBI) patient encounter files, prepared prior to the experiment due to the large volume of patients, were simply uploaded into the MeWS database for subsequent analysis. CINC-21 collaborative planning tools (multi-point net meeting with/without video) were also used during this experiment, but were not the primary focus of the exercise.

Biological warfare agents are inherently difficult to detect. It is likely that detection of an attack will only occur upon initial diagnosis of the agent in the military population. As a result, this experiment concentrated primarily on MeWS and MDSS epidemic detection and analysis capabilities. Also examined were the decisions made by the JTF Surgeon and staff¹ and subsequent medical coordination efforts with Commander-in-Chief, Pacific (CINCPAC) Surgeon and staff.

Final results from this exercise indicate that JMO-T ACTD can alert on an emerging epidemic. Because this alert is not automated, actual detection of an alert requires additional time and effort by JTF personnel. The technology does not, however, provide

¹ Similar analyses using another epidemiologic software package, Global Epidetionary Medical System (GEMS-A), was carried out August 2000 during FBE-H. Ward, KM and McGrady, ED. *MC00/FBE-H Biological Warfare Limited Objective Experiment (U)*. CNA Research Memorandum CRM D0003627.A1, March 2001 (SECRET).

a diagnostic capability to the JTF Surgeon. After an alert in the military population, a manual workaround developed by the JTF surgeon provided a diagnosis, after analysis of 24 patients in 90 minutes. Similar analysis using this manual workaround on a second exercise alert would have taken over 2 weeks. Instead, an alternative software workaround developed during the exercise enabled diagnosis after analysis of 6000 refugee patients in 30 minutes.

In the military population, both analysis tools (MeWS, MDSS) alerted the JTF Surgeon to an unusual level of respiratory illness on the first day of the exercise. These unusual levels continued until day three when a detailed analysis of clinical signs/symptoms revealed the possibility of a bio-warfare attack against the Task Force. Following earlier notification of the JTF Commander, the JTF Surgeon, using the CINC-21 reach-back capability, was able to discuss these findings directly with CINCPAC Surgeon. This resulted in notional tasking of rapid laboratory assets to the Task Force in order to conduct confirmatory investigations of the possible bio-warfare event. The CINCPAC Surgeon also concurred with JTF Surgeon actions on immediate antibiotic treatment and prophylaxis of Task Force service members.

MDSS alerted on the initial day for the three separate epidemics of malaria, gastrointestinal disease, and measles in the refugee camps. These alerts were based on the grouping of specific ICD-9 codes into category syndrome groups (respiratory, GI, fever)². These results demonstrated the alert capability against a large background set of sick patient information, as compared with the previous mentioned alert arising from ~300 military patients.

A number of software limitations, however, hampered the medical and operational effectiveness of the JMOT-ACTD. The next requirement following initial detection of an unusual medical event is the determination of the cause(s). A working diagnosis can be obtained through analysis of clinical signs and symptoms or through laboratory testing of tissue and/or blood samples. Because laboratory capabilities are severely limited at sea, the ability to analyze clinical signs and symptoms is absolutely necessary to ensure an appropriate medical response.

MDSS does not currently offer the user access to clinical sign and symptom information, though it is contained in the database. During FBE-I, a non-automated "stubby pencil" analysis of MeWS and MDSS data was conducted following the initial detection of the military epidemic. This enabled the JTF Surgeon to determine an appropriate differential diagnosis (tularemia) and to dictate his subsequent medical decisions. This type of manual analysis is viable only for a small patient population (24 patients in this exercise). The significantly larger refugee epidemic (requiring analysis of 6000 patients) could not be analyzed using MDSS in its current form.

² A similar strategy for biological surveillance is suggested by Brinsfield, KH, et al. 2001. *Using Volume-based Surveillance for an Outbreak Early Warning System*. Academic Emergency Medicine. 8(5) 492.

- Recommendation: Implement the software workaround (written on-board USS Coronado during FBE-I) to access the entire MDSS database for subsequent download into Excel or other user-desired spreadsheet analysis software package.
- Recommendation: Implement Epidemiologic Wizard (EpiWIZ) in MDSS software suite for use by medical operators. Future experiments should specifically focus here, utilizing either real or simulated patients, to enable operator feedback on this interim epidemiologic capability.
- Recommendation: Develop "key word" search and analysis capability for future inclusion into MDSS. It must also include the ability to group a specific list of signs and/or symptoms as well as to require one specific sign or symptom. These lists could be saved as core analysis parameters either as determined by higher authorities or as written by the deployed end-user.

Another drawback stemmed from current manning levels on the JTF Surgeon's staff. These are inadequate to exploit the totality of information available from this technology. For example, initial detection of an outbreak using MDSS is not an automatic function of the software. Instead, it depends upon user review of each specific disease category listed for all JTF operating units, both individually and collectively. Because of the sheer volume of information, this review alone is a significant task for a single individual. Additional requirements for JMO-T ACTD medical information only added to the workload of the JTF Deputy Force Surgeon during FBE-I. These included inputs to JTF Commander's briefings, website updates, database downloads to CINCPAC, and daily interactions with CINCPAC.

- Recommendation: Determination of appropriate additional JTF Surgeon staffing levels (not limited to on-board personnel, if mirrored website MDSS access is available).
- Recommendation: Determination of standardized review procedures and requirements to ensure complete review and consistent analysis of population database.
- Recommendation: Future JMO-T ACTD developmental efforts should provide an automated presentation of the initial MDSS detection of any/all outbreaks to the user upon login, rather than via systematic operator review.

A final drawback arose from the "sneaker-net" workaround required by CINC21 and JMO-T ACTD security requirements. As a result, consistent information disconnects were noted during FBE-I. Optimal use of JMO-T ACTD in collaborative planning and response to medical events requires rapid and secure communications, which include both voice and data transmission capabilities. The information available is both an OPSEC vulnerability and a significant privacy issue, since this technology provides complete access to individual patient medical records. Accordingly, numerous security

issues remain that were not addressed by this experiment but which need to be evaluated in future efforts.

- Recommendation: Future medical experiments should ensure that communications are rapid, reliable, and secure in order to take fullest advantage of the collaborative capabilities of new technologies.

JMO-T ACTD functions that were successfully demonstrated during FBE-I included:

- Initial alert on and detection of epidemics: All four exercise epidemics were detected on the first day of each epidemic.
- Database reliability: The MeWS server was robust and dependable. No problems were experienced with the server during the entire exercise, despite the fact that it was operating 24 hours a day on laptop computer technology.
- Up-to-date medical status of forces: The MeWS watchboard, patient tracking capabilities, and TCAS e-mail connectivity worked consistently well throughout the exercise. This particular exercise scenario, however, was not designed to specifically exploit these functional capabilities. Future experiments could focus on these particular MeWS capabilities, utilizing either real or simulated patients, to better demonstrate the value of these functions in operational situations.
- Collaborative planning and communications: The combination of JMOT-ACTD with CINC-21 communications facilitated the rapid and coordinated responses between the JTF Surgeon/staff and CINCPAC Surgeon/staff.

FBE-I Exercise Report

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Introduction

FBE-I Far Forward Casualty Care Initiative was designed to examine the utility of medical analysis tools (JMO-T ACTD) for their value to the Force Surgeon and to the JTF Commander. JMO-T ACTD is a prototype of an advanced medical information system designed to enhance force health protection and medical decision making capabilities. This system was evaluated during FBE-I using a combined military and civilian refugee scenario, with the primary focus on the detection and analysis capabilities offered by JMO-T ACTD epidemiologic alert and analysis functions.

Technologies employed:

Medical Decision Support System (MDSS)

MDSS is the medical event detection and the primary epidemiologic analysis tool of JMO-T ACTD. It is responsible for identifying and alerting significant medical events in patient encounter data. Various functions in MDSS include:

- Disease trend analysis
- Means and standard deviation calculations
- Outliers determined (between 1-3 standard deviations away from mean)
- Bursts determined (greater than 3 standard deviations away from mean)
- DNBI category groupings (Based on ICD-9 codings)
- Individual patient file review
- Summary reports

The disease trend analysis function requires either background historical data or at least the previous 5 days worth of patient information. This experiment provided 10 days of background patient information from the scenario refugee camps.

Medical Work Station (MeWS)

MeWS acts as the central database for incoming patient medical encounter files and provides database snapshots periodically to MDSS for subsequent analysis. It also handles information relating to the medical status of the MTF using standardized Annex Q reporting. It tracks:

- Medical personnel (manning levels vs actual)
- Number of Injured military personnel
- Bed status per medical unit

- Medical supplies
- Blood supply status
- Patient movement tracking

In addition, the Team Care Automated System (TCAS) function of MeWS permits on-line direct e-mail connectivity between remote medical providers and the JTF Surgeon.

Exercise partnerships

Other partners who contributed to the Far Forward Casualty Care Initiative included:

- Extending the Littoral Battlespace (ELB) ACTD
- CINC-21 ACTD
- Commander in Chief, Pacific (CINCPAC) Surgeon
- Commander Third Fleet (COMTHIRDFLT) Surgeon
- I Marine Expeditionary Force (I MEF) Surgeon
- Navy Environmental Health Protection Unit Five (NEPMU 5)
- Navy Health Research Center (NHRC), San Diego CA
- Science Applications International Corporation (SAIC), San Diego CA
- Management and Technical Services (MTS) Technologies, San Diego CA
- Space and Naval Warfare Systems Command (SPAWAR), San Diego, CA
- Maritime Battle Center (MBC)
- Center for Naval Analyses (CNA)

Exercise Scenario

The major focus of this medical exercise was to evaluate the ability of JMO-T ACTD to detect and to subsequently analyze a potential bio-warfare event. In order to do this, the exercise scenario was divided into two pieces, one involving military injured and DNBI patients and the second involving significant number of sick civilian refugees.

The refugee scenario piece involved a total of ~75,000 refugees (total) divided among five camps: Camp Teal #1, Camp Teal #2, Camp Teal #3, Camp Grey #1, and Camp Grey #2. Country Teal and Country Grey were nominally neutral countries that were not otherwise active in the overall FBE-I exercise scenario.

Using real World Health Organization (WHO) surveillance data on specific diseases (as recorded from recent events in East Timor), the most frequent five diseases were chosen for use in the refugee camp portion of this scenario. These included upper respiratory infection (URI), lower respiratory infection (LRI), malaria, diarrhea, and diarrhea (without blood). Measles was also included in the scenario, because of its ability to spread disease and death rapidly in a population of unvaccinated children. The relative frequencies of these diseases were calculated from the WHO data. These percentages were then scaled to yield a 5% overall disease incidence rate in the population of divided among the five refugee camps.

Patient files were developed using the East Timor disease statistics for ten background days (injected into MeWS/ MDSS prior to exercise start) and the first three days of FBE-I. Three epidemics were designed into the scenario database – malaria and diarrheal outbreaks occurred in all camps on the first day of FBE-I, with an outbreak of measles occurring in Camp Grey #1 on the second day. An additional outbreak of URI occurred via message traffic only in Camp Teal #1 on day six of the exercise, which required re-analysis of the original URI data from all refugee camps. This structure was designed to examine MDSS detection ability for epidemics that occurred at two different threshold levels in addition to an epidemic “spike” (low numbers, but high interest).

Patient record development

Computerized patient records were built using the five diseases for the 10 days of background camp data. These records contained a subset of standardized medical information (that MeWS and MDSS data structures support) including:

- MTF
- SSN
- DOB
- Last name
- First name
- Branch
- Unit
- Command
- Gender
- Nationality
- Event location
- Primary diagnosis
- Primary ICD9 code
- Secondary ICD9 code
- DNBI category
- Disposition
- GPS location
- Encounter date
- Report date
- Free text field

These text fields were chosen to mirror the medical inject capability of the Joint Medical Semi-Automated Forces (JMedSAF), which had originally been scheduled to design the patient populations, but was unable to do so. It is important to note that standardized SAMS patient encounters do not contain the following fields: Primary Diagnosis, Secondary Diagnosis, DNBI category, Encounter Type, Patient Type, or Age.

The free text field was added to the data structure of MeWS and MDSS as a way of adding signs and symptoms for exercise purposes. It was originally anticipated that this

free text field was searchable in MDSS. When this proved not to be the case, both the primary diagnosis and specific ICD9 codes were also added to each data set. A similar SAMS specific function, the SOAP note (Subjective, Objective, Assessment, Plan of care) involves a free text entry by the medical provider. The SOAP note is also not currently searchable utilizing MDSS, but is viewable in the patient record review function.

Primary diagnosis and ICD9 codes were standardized for this patient population. This is not a realistic expectation in real world operations, but it made for a "cleaner" experiment data set. This also enabled MDSS to parse the patient files into the specific DNBI categories (Gastrointestinal, Respiratory, Unexplained fever, Other), where the statistical analyses occurred.

| Primary diagnosis | ICD9 code | DNBI Category |
|-------------------|-----------|-------------------|
| Diarrhea | 558.90 | Gastrointestinal |
| Bloody Diarrhea | 009.30 | Gastrointestinal |
| URI | 465.90 | Respiratory |
| LRI | 486.00 | Respiratory |
| Malaria | 780.60 | Unexplained Fever |
| Measles | 055.90 | Other |

In addition, a matrix was set up to provide a range of clinical signs and symptoms normal for each disease. Each patient's signs/symptoms were the result of a randomized selection from each column of the matrix for that disease. For example, one patient might have Symptom A1, Symptom B6, Temperature 4, and Blood Pressure 5 listed in the free text field of their patient encounter record. Note: this included "normal - non-diseased" symptoms and signs - not every patient would show every disease sign or symptom.

| Symptom | Symptom | Sign | Sign |
|---------|---------|---------------|------|
| A1 | B1 | Temperature 1 | BP1 |
| A2 | B2 | Temperature 2 | BP2 |
| A3 | B3 | Temperature 3 | BP3 |
| A4 | B4 | Temperature 4 | BP4 |
| A5 | B5 | Temperature 5 | BP5 |
| A6 | B6 | Temperature 6 | BP6 |

Additional military DNBI patient files were also developed using this same file generation strategy. Approximately 20 DNBI patient files were provided for each of eight days of FBE-I. No measles patients were developed; otherwise, the same diseases as the refugee camp scenario were used (URI, LRI, diarrhea, diarrhea (with blood), malaria).

Wargame Observations

One month prior to FBE-I, a preparatory wargame was conducted on board the USS Coronado. The purpose of this wargame was to provide for systems integration and operator training in advance of FBE-I. The observations that follow are primarily concerned with problems encountered in the initial set up and data injects into JMOT-ACTD. These arose partly because the system is early in its developmental cycle. Because most of the wargame was tied up with documentation and resolution of these problems, the JTF Surgeon and staff gained little experience with JMOT-ACTD prior to FBE-I.

The following issues lessened the operational effectiveness of JMO-T ACTD during the FBE-I Wargame:

- Initial problems occurred between MeWS and MDSS communications such that the systems could not exchange data. As a result, MDSS could not receive the database "snapshots" for subsequent analysis which MeWS, as the overall database for JMO-T ACTD, would normally provide.
- MDSS was unable to parse the ICD9 codes into their appropriate DNBI categories. This resulted in all patient files being filed into the DNBI category "Other". No detection nor additional analysis was possible until this problem was corrected.
- After the above parsing problem was fixed, subsequent review of the known wargame baseline data set indicated that too many patients in each disease category were being counted by MDSS. This occurred because the system was counting all visits (initial and follow-up) as initial visits, and calculated visit statistics accordingly.

Exercise Observations

JMO-T ACTD /Collaborative Planning

Throughout FBE-I, JMO-T ACTD information was used to assess the current medical readiness state of the Joint Task Force. Daily interactions with the CINCPAC Surgeon and CINCPACFLT Surgeon, via CINC 21 teleconferencing and exercise website updates, also enabled a “near-real time” medical operational picture to be maintained at those higher commands.

Daily collaborative discussions were used:

- To review daily FBE-I operational and intelligence information
- To review and update current force medical capabilities (MeWS watchboard)
- To review previous day’s data from both military and refugee camps (MDSS)
- To discuss significant medical events
- To discuss courses of action (COA) in response to exercise MESL messages

The ability to conduct this teleconferencing enabled directed medical discussions, treatment recommendations, and additional actions following:

- The initial detection of a potential bio-warfare incident in the military population on exercise day 1
- The initial assessment of the clinical signs and symptoms of 24 military patients on exercise day 3
- The requests for Navy Environmental and Preventative Medicine Unit 6 (NEPMU-6) assistance, initially for refugee camps on exercise day 1, then for the JTF itself, to provide on-site laboratory testing and preventative medicine capabilities
- The request for assistance with malarial outbreak on exercise day 1
- The request for civilian epidemiologic and laboratory support to Country Teal following animal disease outbreak on exercise day six
- The requests by refugee camps for food and medications throughout the exercise.

There were some problems, however, due to security issues and communications connectivity, with use of the system in conjunction with CINC-21. These problems resulted in less than optimal collaborative efforts.

- JMO-T ACTD did not have direct connectivity with the Joint Operations Center (JOC) while the teleconferencing capability of CINC-21 was available only in the JOC. As a workaround, the JTF Surgeon used MeWS and MDSS screen shot files while in the JOC. These same files were also sent to CINCPAC in order to facilitate discussions. This particular workaround effectively limited the teleconference discussions to those particular slides. In addition, because these slides were consistently prepared the night before, prior to the upload of current day patient data, they did not contain the latest information.

- Additional problems were noted in sending the screen shot files and daily MeWS database snapshots to CINCPAC. Teleconferenced discussions held on the first three days of the exercise were conducted without receipt of these e-mails (due to a five hour transmission delay), again resulting in sub-optimal discussions.
- The exercise participants preferred the use of audio, rather than text chat, during their interactions. This preference resulted in significant use of non-secure communications channels (i.e. POTS).
 - CINC-21 was continually hampered by audio problems (transmission line problems, simultaneous VTC usage). Every discussion wasted between 25% and 50% of the available time window attempting to regain audio contact after its loss. This was in spite of the availability of text chat throughout every session. As a workaround, the POTS line to Hawaii was used during some of the discussions. In a real-world situation, however, security issues would likely preclude use of this non-secure capability.
 - Because of the loss of SIPRNET connectivity, the final collaborative discussion was not held using CINC-21. Instead, it was held entirely via POTS on speakerphone, following transmission of MeWS data and discussion slides to CINCPAC.

Neither operational security and patient privacy issues were addressed during this exercise. In fact, numerous unclassified POTS phone conversations were conducted during the collaborative planning sessions upon failure of CINC-21 audio capabilities. Both sets of issues are crucial to the success of this technology and should be addressed in future experiments.

JMO-T ACTD / JTF Surgeon Staffing levels

These technologies offer a significant amount of operational information for analysis. The Deputy JTF Surgeon was tasked with all MDSS detection and analysis. This tasking also included the preparation of the information in formats appropriate for various CJTF requirements (exercise website updates, evening briefings) and for collaborative discussions with CINCPAC (powerpoint slides). The JTF Medical Planner was tasked with all MeWS information, analysis, and updates. This included MeWS watchboard data downloads in addition to CJTF information requirements and CINCPAC discussion points.

Because none of the detection or analysis tasks have been automated in either MeWS or MDSS, all available information screens must be manually reviewed by these operators. A complete and standardized review alone is a considerable task.

Consider, for example, if MDSS alerted on possible outbreaks in two different DNBI categories in two different units of a seven member task force. In order to detect any alerts, an effective search approach might be to look at the over-all task force first, to see if any of the 15 separate DNBI categories reveal a problem. For this example, that

review would indicate that a problem might be present in two of the categories. Additional analysis of these two categories will then require a review of that category on each of the seven units, to determine the specific problematic unit(s). This surveillance strategy would require a total of $15 + 7 + 7$ screen reviews before the surveillance task could be complete. If each review takes 3 minutes, almost 90 minutes would have been spent in just that single day's detection task.

Other tasks in MDSS and MeWS, in addition to the detection task outlined above, might also be candidates for automation. These could include a wide variety of standardized slide outputs (for briefing purposes, website uploads) to facilitate the dissemination of information among the various operational and medical users. Until this level of automation is provided by the software, more personnel will likely be required to provide an interim capability.

JMO-T ACTD / "Within System" Communications

This experiment also demonstrated the use of multiple communications (Extending Littoral Battlespace (ELB) Warnet, HF, SATCOM) to transmit information from remote sites into the MeWS database. Direct and prioritized e-mail communications between remote sites and the JTF Surgeon were facilitated by the TCAS (Team Care Automation System), a specific MeWS function. In future operations, standardized patient files (similar to those used for simulated patients in this exercise) could be transmitted using this technology, including data obtained from non-military providers.

Transmission of datafiles within JMO-T ACTD may be best accomplished in a "packet" mode, as compared with a live-entry/transmission, especially during a limited data transmission window. The current form of data entry via end-user terminal technology (EUT) may also not be suitable for combat corpsmen, but might be more suitably employed at higher echelons of care, again due to operational time constraints.

- Each prepared patient encounter file took less than 30 seconds to be uploaded and transmitted over the communications path into the MeWS database.
- Using the end-user terminals to enter data directly was significantly more time consuming, taking up to 20 minutes to enter an entire file prior to transmission.

JMO-T ACTD /MeWS

Numerous functions in MeWS worked as "proof of concept" demonstrations during the experiment but require additional medical user feedback and refinement prior to operational deployment. These included:

- Report capability
- Medical watchboard
- Database

Functions which were not demonstrated during FBE-I, but which would be valuable to the JTF Surgeon, included the graphical display of information, which was not available but is anticipated in the near future. In addition, little capability was observed in managing information that may be available through non-electronic means. For example, message traffic containing numerical refugee data could not be entered into the operational picture presented by MeWS or by MDSS. No feature exists in either MeWS or MDSS to permit use of this type of non-standardized information.

JMO-T ACTD /MDSS Alert and Detection

MDSS correctly alerted on all three epidemics present in the refugee portion of the scenario. These epidemics were structured to test MDSS alert capabilities at three different threshold levels. These included "burst", at more than 3 standard deviations away from the population mean, "outlier", between 1 and 3 standard deviations away from the population mean, and "spike", for a disease where no background population data exists. Detection followed operator review of the color-coded bar graphs of ICD-9 coded disease information as developed from all camps and from each single camp.

- The malaria epidemic occurred on day one with an outlier in the data in all camps. The epidemic increased to the burst level on subsequent exercise days.
- The gastrointestinal outbreak occurred on day one with a burst in the patient population data in all refugee camps. This level of disease continued throughout the next two days of the exercise.
- Detection of the measles outbreak occurred as a spike of cases against a non-existent background population in two of three of the camps.

Without the MDSS automated analysis and data presentation, detection of these three epidemics would have required a significant amount of time and effort by the JTF Surgeon's staff.

- Future developmental efforts should concentrate on automation of this detection process. Currently, detection depends upon complete operator review of all the available MDSS information looking at each DNBI category by unit and by total force. Instead, this information should be combined into a single daily alert message for operator review.

In addition, while there were lesser numbers of military patients, the first day's data on respiratory patients was immediately of interest to the JTF Surgeon and staff epidemiologist, because it was approximately twice the normal level (based on operator experience).

JMO-T ACTD /MDSS Analysis

Detection occurred as the result of MDSS analysis of ICD-9 code information, divided among four DNBI categories (fever of undetermined origin, gastrointestinal disease, respiratory disease, other). This information yielded the information that “something” seemed to be a problem in three of the four DNBI categories.

Following initial detection of an unusual medical event, the next step in medicine relies on the ability to diagnose disease. Unfortunately, on-board laboratory capabilities are limited and deployable technical assistance will be days in arriving on-scene. As a result, rapid analysis of signs and symptom information is the most viable way to determine a differential diagnosis. However, as currently configured, MDSS provides no capability to review or to analyze patient records for specific clinical sign and symptoms.

- MDSS contains an “Ad Hoc” epidemiologic analysis tool. The purpose of this tool is to permit a more in-depth review of the patient database and to facilitate subsequent user-defined searches.
 - The information available in the Excel spreadsheet does not provide the appropriate level of detail required. DNBI category listing is the sole piece of medical diagnostic information currently available to the user through this function.
 - Even ICD-9 code (final diagnosis) information is not contained in the spreadsheet, in spite of the fact that statistical analysis of this information results in initial MDSS alerts.
- Patient records can be reviewed, individually, in MDSS. SOAP note information (free text consisting of Subjective, Objective, Assessment, Plan of care information) is available at this review level.
 - SOAP note information is not currently accessible via the Ad Hoc analysis function.
 - The free text field used to provide signs and symptoms in this exercise was not accessible either through the individual record review function or through the Ad Hoc analysis function in MDSS.

Patient records developed for this exercise utilized a free text field that was only accessible through the MeWS watchboard. The JTF Surgeon used a listing of the Ad Hoc Excel spreadsheet data (names, units) to organize his review of individual patient records accessible through the MeWS watchboard. This review resulted in a differential diagnosis of tularemia, a potential bio-warfare agent³. The diagnosis was based on the consistent presence of two specific clinical features indicative of tularemia within the

³ Dennis, DT, et al. 2001. *Tularemia as a Biological Weapon*. Journal of the American Medical Association. 285((21):2763-2773.

context of these upper respiratory infection (URI). Both conjunctivitis (red eyes) and temperature/pulse dissociation were consistently observed in the majority of this URI patient population:

- The analysis of 24 upper respiratory infection patients took 90 minutes.

Later in the exercise, intelligence information and specific host-country message traffic indicated that an additional URI outbreak was occurring in refugee camp Teal #1. Analysis of this outbreak was requested, within the context of the 13 days of data (6000 patients) available to the JTF Surgeon.

- The manual workaround via MeWS would have taken approximately two weeks of constant analysis. $((90 \text{ minutes}/24 \text{ patients}) = 3.75 \text{ minutes/patient} \times 6000 \text{ patients} = 22500 \text{ minutes} = 375 \text{ hours} = 15 \text{ days})$
- During the exercise, a software work-around was developed to the MDSS Ad Hoc spreadsheet function which enabled the download of all available patient data, including signs and symptoms.
- The JTF Surgeon was then able to analyze the 6000 patient records in 30 minutes.
- The same differential diagnosis, tularemia, was also indicated based on a similar presentation (conjunctivitis, temperature/pulse dissociation) in the refugee URI population.

JMO-T ACTD/ MDSS Miscellaneous

There are a number of additional refinements necessary to the data structures and graphics outputs from MDSS. More interaction between the developers and operational users is likely to result in significant improvements in the man-machine interface and the overall presentation of information.

- MDSS files are structured to contain Date and Time together in a single field. This data structure hampers subsequent Excel analysis and sorting, because each report cannot be easily sorted by Date alone. Most epidemiologic analysis is done on a per/day basis, rather than by moment-to-moment analysis.
- Graphical presentations are structured as bar graphs; Date is the horizontal (x) axis, numerical patient counts or patient rates are presented along the vertical (y) axis. The bar graphs have been standardized into a perfect square. A number of problems arise from this standardization:
 - The y-axis is divided evenly between the maximum value observed for any given data set and zero. For data containing total patient counts, this results in data annotated with decimal (versus integer) numbers. This is inappropriate and requires correction to integer format.

- The y-axis is not annotated if the maximum value observed from the data is less than one. This commonly occurs during analysis of rate-oriented data and results in a graph which essentially contains no information due to the lack of an annotated y-axis.
- No graphical output (y-axis scale, x-axis scale) can be altered by the operator.

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